THE ZOOLOGIST

No. 805.—July, 1908.

SPECULATIONS ON THE ORIGIN AND DEVELOPMENT OF THE PARENTAL INSTINCT IN BIRDS.

By Bruce F. Cummings.

I.

Birds do not show a great many gradational types from simple to complex forms in the development of this instinct, but there are sufficient to indicate the base-lines along which it has progressed. Allowing always a broad margin for various circumstances which, wholly unknown to us, may have considerably modified its development or altered its course, I hope to suggest in the following paper the necessary conditions for its origin, and the forces which have moulded its subsequent advancement.

I assume that the instinct, at its earliest dawn, originated primarily in an unconscious way by the natural selection of chance favourable variations of unconscious habit, for it seems evident that a bird would find no just cause for any self-sacrificing attention to a hard uncomfortable object of which it has just ridded itself, and which we call an egg. And so Romanes has pointed out that the incubation instinct can only be explained as arising from the results of natural selection, and not as an action, originally intelligent, since stereotyped into mechanical instinct, as the reason why they sit could never have presented itself to the birds, for it would imply at least a scientific knowledge of the properties of the germinal area of the egg.

The majority of fishes, amphibians, and reptiles, from which latter, it must be acknowledged, our birds are derived, possess no parental instinct which is so remarkable a characteristic of the birds. But most animals possess that very elementary kind of parental instinct—typical of the insects—which informs them of the most suitable places for the dropping of their eggs.

Similarly, in ages long ago, the females of birds probably dropped their eggs at random in a variety of situations in more or less suitable localities on the ground. No special receptacle was made, but the eggs were laid in just those places where the female happened to be at the time of her accouchement; so that the eggs of a single female were scattered one by one over perhaps a wide area. These eggs, left with heartless nonchalance by the parents, would be hatched by the heat of the sun, or by inanimate substances. The young, at hatching, would be perfectly capable of looking after themselves. Possibly they would be able to fly within an hour or so.

In cold climates the sun would not be hot enough for the hatching of eggs, but at that time the eggs may have materially differed from those of to-day in the amount of heat required, while the two hemispheres may have been generally warmer, for even the Arctic Regions show abundant evidence of having been favoured—in the Cretaceous epoch, for example—with a hot climate and rich vegetable life. The gradual decline of this heat and the approach of Arctic conditions were no doubt instrumental in inducing parental affection and increasing the incubation duties. A few species which still resort to the heat of the sun now linger in the Tropics.

Many species in a fit of carelessness occasionally, even at the present time, drop their eggs on the bare ground and leave them, *viz.* many of the ground birds, *Molothrus vulgaris* and *Sturnus vulgaris*, and others.

These primitive birds, with little or no parental instinct, laid a very large number of large eggs.

The reason for this was that the risks to which the eggs were exposed were very great, and only a few of the embryos which happened to fall in with suitable circumstances would ever arrive at maturity. The eggs were large in order to contain the in-

creased amount of food-yelk necessary to enable the young birds to be hatched in an advanced stage of development, and fully equipped to fight the battle of life alone.

Lichenstein remarks that but for its numerous enemies the multiplication of the Ostrich would be quite unequalled, and it is a primitive bird with very little parental instinct.

The fact that the number of eggs varies, *ceteris paribus*, with the risks is well shown by the facts which are known to occur among fishes. The Herring (*Clupea harengus*) lays thousands of eggs—a fish which possesses no parental instinct, and whose eggs are exposed to all the dangers and vicissitudes of ocean life. The ova of the oviparous *Elasmobranchii* are comparatively few in number, as they are afforded very considerable protection by a tough, leathery, protective envelope. Fishes show a remarkable fecundity because they, unlike the birds, do not arrive at a permanent size. They grow continuously, and this causes the struggle for existence to be severer and the risks greater.

Birds in these remote times were probably to a great extent polygamous, or, at all events, a very loose sort of pairing obtained. As there was no need for any parental instinct or prolonged care of the eggs, the females and males, after copulation, had no reason to remain paired off; they had no severe mental tax laid upon them such as the care and training of young helpless birds entails, and were therefore open to sustain the demoralizing effect of promiscuous pairing. Possibly a large majority of the fishes are polygamous, and a sort of "panmixia" appears to occur among amphibians and reptiles of some species.

The Ostrich tribe and a great many of the *Gallinæ* are polygamous. The Ostrich (*Struthio camelus*) presents an interesting intermediate stage. She still lays an enormous number of eggs, but the male of the species, apparently, has begun to carry out the onerous duties of incubation. Though the species is still decidedly polygamous,* the females take a share in sitting; the male, however, does most of the work.† If the Ostrich were to make any intellectual advance, it would commence with the reduction of eggs and wives, and the increase in sexual and

* On this point *cf.* S. C. Cronwright Schreiner, 'Zoologist,' 1897, p. 115. —Ed.

† *Cf. loc. cit.*, pp. 109–110.—Ed.

parental affection. The offspring would probably be more vigorous.

The parental instinct of birds, once established, no doubt helped to produce the present complex condition of that reason and intelligent adjustment to surroundings which, without any danger of being called unscientific and anthropomorphic, I hold all birds incontestably display.

The elementary condition of the instinct which I have sketched was not a very permanent one. The females would find it an economy of energy in looking for suitable localities by always returning to the same spot, and so the eggs instead of being scattered would be laid in a clutch; or if in any district suitable localities were not numerous, the few localities that did exist would become overcrowded with eggs, and ground vermin and egg-eating birds would be attracted. This would threaten extinction, but the birds would respond by attempts, crude no doubt at first, at driving away their enemies and guarding the eggs. This would be the inception of the parental instinct. The male, being the more bellicose of the two sexes, would be the first to assume these watch-dog duties; moreover, should this species be an egg-eating one itself, the males would be forced to guard the eggs against their own females. To do this more successfully the male would collect his spouse's scattered products, and this again would result in the eggs being laid in a clutch, for the female, through the action of natural selection and her own enlightened intelligence, would not be slow to fall in with the male's domestic arrangements.

Another way of meeting these adverse circumstances and the onslaughts of enemies, but a way not adopted, was a further increase in the number of eggs—a tax on the organism as a machine, but not as an independent intelligence. In some such accidental atmosphere must have arisen the germ not only of the paternal instinct but of the whole of the bird's large and varied mental capabilities; for, like charity, intellect begins at home, and just as civilization is dependent on the relative perfection of the community, so the community is dependent on the condition of family life.

If only for their own convenience, when undergoing the ordeal of egg-laying, the females would tend to be secretive

over their nesting-site. They would choose quiet unfrequented nooks. Some would bury their eggs in the sand or under dense herbage.

The instinct which prompts the Turtle to leave its eggs in the sand to be hatched by the heat of the sun is in no point inferior to that of the Maleo of Celebes, whose method of nidification is precisely the same. This we may take to be a primitive case, and one where, in order to meet pressure imposed, natural selection chose to act on the sagacity of the female rather than on the pugnacity of the male. (*Cf.* p. 247, l. 18.)

The Brush-Turkeys (*Talegallus*) heap fermenting vegetable rubbish over their eggs, but show a slight superiority to the Maleo, for the male is said to guard the heap, which must certainly be a conspicuous object.

All the females of each polygamous male of primitive birds probably laid their eggs together in one large nest. This obtains with the *Talegallus*, *Struthio*, and others. This habit, like a great many other primitive though ingrained remnants of the history of evolution, still persists in cropping up as "sports" in a variety of birds. Audubon found three females of *Meleagris gallipavo* which had laid eggs in one and the same nest. They were sitting on forty-two eggs, so that each bird covered fourteen eggs. The American Rhea is not averse to making use of a neighbour's burrow in which to lay her eggs, and so with Pheasants, Partridges, Wild Duck, and Long-tailed Tits. The Game-birds and Plovers, Gulls, &c., sometimes, in thus reverting, make the mistake of laying their eggs in the nest not of one of their own but another species. Such an accident as this was undoubtedly the origin of the parasitic habits of the Cuckoo. A respectable, homely, and affectionate Cuckoo perhaps impulsively reverted to a nesting trait of her primitive ancestors by laying her eggs in the nest of an unsuspecting neighbour. When the species had generally commenced this retrogressive though luxurious method the nests of other species would have to be imposed upon, and so the well-known and parasitic habit of the Cuckoo would gradually be evolved.

Molothrus bonariensis, a parasitic bird, throws an occasional "sport." Several females begin to build an untidy, irregular nest of their own, in which they together lay as many as fifteen

to twenty eggs; otherwise this species is strictly parasitic (see Darwin in his chapter on "Instinct" in the 'Origin').

Of course, a large number of birds of the present day show a tendency to the primitive habit of leaving their eggs to hatch of themselves, *viz.* Emus, Grebes, Plovers, and others. Some cover their eggs when leaving them (*Anas boschas*, and others); others, again, only during the period before the whole clutch is laid, while the bird is not sitting, viz. *Parus major*, *P. cæruleus*. And so, the male jealously guarding the eggs, or, in some cases, the female carefully secreting them, would ensure the safe procreation of the species, and that species would ultimately win in the struggle for existence.

Though no one denies that Nature is profoundly extravagant, it is no contradiction of terms, and even more true to say that she is economical and thrifty too. No more eggs are laid by any bird than are necessary. With things at this juncture the necessity for so large a number of eggs would go, as the guarding male would eliminate so many of the risks. The reduction of eggs means an economy of food-yelk manufactured by the female, who would in turn receive an accentuation of vigour in some system other than her reproductive one. We must remember that Darwin's great principle of the struggle for existence is universal, and occurs even between the integrate parts of the same organism. In this case the nervous system benefits at the expense of the reproductive, while the young birds would undoubtedly be stronger and healthier. The production of healthier chicks would probably be the cause of a second lessening in the number of eggs, and this would again react on the young, and so on *ad infinitum*. Furthermore, the parents, instead of attempting to cope with an unwieldy number, would be able to give their undivided attention to the few chicks produced.

But there would be limits. Every species ought to send out into the world annually enough young, not only barely to carry that species through along its own narrow groove, which its heredity and environment have cut for it, but also enough young to allow of the expansion of its area of distribution and power to cope with change of pressure; for, under the rigorous action of

natural selection, a species must advance, or its extinction is simply a matter of time.

The stimulus to advance, *viz.* increased competition, would be responded to by the fact that a sufficient number of young would present a sufficient supply of variations, so that natural selection could grip the more favourable ones with sharper discrimination, and re-equip the species for its new environment.

By reason of the female laying her eggs in a clutch and the male guarding them, the attention of both parents becomes localized on the nesting-site. A proud sense of ownership possesses the male, and a stealthy secretiveness the female. It does not require great imagination to see that the step from guarding the eggs to sitting on them is not a long one. The male to escape a superabundance of attacks would attempt to make himself less in evidence. When an enemy came in view he would bob down on the eggs, and, finding them warm and comfortable, would continue to sit.

A curious fact is that among the birds, and even among the vertebrates generally, the male is generally the first to assume the responsibilities of domestic life. The male is the original mother. Consider the male's psychic qualities—he is the most vigorous, most pugnacious of animals, and the sex that courts, and, indeed, shows himself to be the most impressionable of birds. The female is passive.

Among the fishes, the male, almost without exception, is the only sex which shows any attachment to its eggs, and even then it is rather a piscine affection. It is the male Surinam Toad (*Pipa americana*) which carefully places the eggs on the back of the female. It is the male of *Rhinoderma darwini*, of Chili, who carries the female's eggs; it is the male of the Obstetric Frog (*Alytes obstetricans*) who assumes maternal duties, and twists the eggs round his hind limbs. Even among the invertebrates the maternal male is not unknown, *viz.* in the Pycnogonida. Among reptiles, however, it is apparently the female Python which sits on the eggs. Mammals, of course, produce substantial anatomical evidence of the male's former association with the female in suckling and in the care of the young. In the birds, of course, the males of *each species* in the *Ratitæ* incubate, while only in a few instances are the females allowed to have a

care in the eggs at all. And so it is with many other primitive birds. In the Bustard-Quails and Phalaropes, and one or two others, the male also does all the sitting, but this is not the primitive habit as developed in the Ostriches, because in the species I have named the female has taken on the characters of the male in every detail. She is larger in size, handsomer, and does all the courting, and she therefore assumes all the enjoyments as well as the hardships of that strange metamorphosis, and the male is left to sit.

With the bird there is no deep inevitable relation between the female and extreme development of the parental instinct. Present conditions, where the female is more generally the maternal parent, are the results of character and difference of temperament in the two birds, and of relative benefits. For example, in a species where sexual selection had already acted, it would be disadvantageous for the brightly-coloured male to sit if the nest were on the open ground, and so the female would take his place. Eggs laid in holes in rotten timber—probably a favourite locality with primitive birds—would require assiduous incubation because of the lack of heat, and it is obvious that this warmth would be amply provided if a division of labour occurred among the two parents. This division of labour would prevent any disastrous weakening effects in the male when he is forced to carry out all the incubation himself. The Spotted Emu (*Dromæus irroratus*), in captivity, has been known to sit for fifty days, during which time it took no food, and only left the eggs five times. The duties of incubation are burthensome at any time, and the males of many species drive their females on to the eggs, and *vice versâ*.

When once incubation became necessary, it was seen that the female was the more suited for it. It would suit the cock-bird more to stand by and fight. She would be acted on by various physiological changes; she would grow broody and want to sit of her own accord. As she grew more and more the sitting bird she would develop that keen sense of possession which would tend to create a somewhat mystic tie, as Prof. J. A. Thomson thinks, between the hen and her eggs. It is a fact well known to all that those hens which do not get broody lay more eggs than do those which frequently become broody. This fact

affords an illustration of the idea that birds with no parental instinct lay large quantities of eggs.

An extreme case of "physiological affection" is met with in the Emperor Penguin of the Antarctic Regions. The females are so filled with a desire to sit that, according to Capt. Scott, they line up behind a sitting female so as to be ready to take her place whenever she rises to leave the egg.

I wonder that more species have not adopted the happy-go-lucky and lazy method of the Owls in not waiting till the full clutch is laid before they sit. The females sit as soon as an egg makes an appearance. The benefits of this are clear as daylight. It lessens the labour of the parents in hunting for and providing food for five helpless young at once, while the incubation is cut short as the warmth from the bodies of the nestlings keeps up the incubation temperature of the unhatched eggs. Probably this is adopted more often than is usually thought. The eggs get buried beneath the young, and the observer, as a rule, is satisfied without lifting them to look beneath. I found Tree-Pipits', a Red-backed Shrike's, and Chaffinches' nests this year with eggs buried beneath well-developed young. The eggs hatched subsequently.

II.—Other Aspects.

Concurrently with the development of the incubation instinct arose the nest-building habit, the chief factors directing which probably were the personal comfort of the sitting bird first, then the protection of the young, and finally the æsthetic taste of the builders. If a female can choose and detect minute differences in form and colour of the males, surely she exercises those powers in the construction of her nest!

All birds were formerly ground-birds most probably. Most of the ground-builders of to-day do little else than breast a hollow in the sand or scrape one in the earth. Subsequently they were driven to the trees, or to holes in the earth and in timber.

When once the parental instinct had secured a firm foundation, and the ties between birds and their offspring became strong and close, all those remarkable tactics, such as the lame devices of the Ducks and Plovers, would be evolved. I

will not suggest that the Plover is fully conscious of the significance of her "lame assumptions," but in a case like this, if we lamely assume the habit to be a blind instinct, we are only raising a dust and then complaining that we cannot see. When Spencer calls instinct "compound reflex action" nobody is any the wiser, but if we accept that every instinct is mingled with "a little dose of reason," as Huber said, then the clouds lift. We understand, then, the relations between instinct and reason; reason and intelligence increase at the expense of instinct, just as inhibition gains control over reflex action, and in proportion with the growth of independent volition.

Nothing is more certain that when birds possessed no parental instinct the young hatched in an active condition, so that they were able to look after themselves; but when parental instinct had advanced sufficiently the young came to be born in a naked and helpless condition, for the male, having permanently acquired the habit of guarding the eggs, would next begin to guard the young birds that hatched from those eggs. And the result of this was that there occurred the possibility of the young hatching in a less developed state, and in a more or less helpless condition.

But the benefits that would accrue from this are not at first sight particularly obvious. Of course, when birds come to sit, smaller eggs would be a necessity, or otherwise the parents would be unable to cover the whole clutch; while extremely large eggs would take a long time to hatch and cause exhaustion to the sitting bird. Again, the reduction of the food-yelk would benefit the producer—the hen—and the young would become healthier.

Among those species where the helpless nestling chiefly obtains, it will be found that they are for the most part arboreal in their habits and great fliers. They are not runners or swimmers. Consequently the young do not possess any running or swimming ability, and the parents build their nests for the most part in trees. If their young, therefore, developed the temporary art of ambulation before the acquisition of the permanent power of flight, they would soon run over the edge of the nest and break their necks. If, on the contrary, they were hatched already with the power of flight, as is the case with the Megapode of Celebes,

the eggs would require to be large, which, as I have pointed out, would be an impossibility with incubating species.

Even admitting that the size of the egg may not be the all-important factor, and assuming that it is the precocious development of the nervous system, allowing of co-ordination of movement, which regulates the conditions of chicks at birth, there must still remain the objection that precocity does not ever mean physical strength, and five minutes chat with a gamekeeper soon convinces one of the delicate susceptibilities of Grouse and Pheasant chicks. So it is necessarily an advantage to a bird capable of caring for them to produce a few—say, four or five—helpless though healthy young rather than a large number of delicate and precocious ones.

Superficially, it looks a convenience at least for any species to give birth to young able to look after themselves; but the chicks, for example, of the Partridge must run a greater number of risks than the parent, possessing at the same time *less ability to cope with them*. Consequently the Partridge has to produce as many as ten young at a brood, not because it has less parental instinct than the Thrush (who would assert that?), who produces four, but because its young are active and run into all kinds of dangers. Active young are really antagonistic to the parental instinct, and hence the advantages of helpless young to a species which has developed this instinct.

ADDITIONS AND CORRECTIONS TO THE 'INDEX ZOOLOGICUS' OF C. O. WATERHOUSE.

(Second Series.)

By E. Bergroth, C.M.Z.S.

In my first series of additions to this work (Zool. 1905, pp. 63–67) about three hundred names were recorded; in this second series nearly two hundred and fifty further names are added. As in the first series, only names published before 1901 are included.

Additions.

Acantherpestes, *Scudder*, Myr., 1882.
Actinelius, *Haeckel*, Prot., 1865.
Ædeophasma, *Scudder*, Orth., 1885.
Ægyria, *Claparède & Lachmann*, Prot.
Agrilium, *Westwood*, Col., 1854.
Agrionides, *Charpentier*, Neur., 1840.
Alaurina, *Busch*, Verm.
Amphicosmus, *Coquillett*, Dipt., 1885.
Anandrus, *Menge*, Arachn., 1856.
Anaxandra, *Stal*, Orth., 1877.
Anisonema, *Dujardin*, Prot.
Anomalites, *Fritsch*, Col., 1884.
Anthobothrium, *Beneden*, Verm., 1849.
Anthracoscorpio, *Kusta*, Arachn., 1888.
Aphioides, *Rondani*, Hem.
Arabella, *Grube*, Verm., 1851.
Arantia, *Stal*, Orth., 1874.
Arrhacia, *Herrich-Schaeffer*, Lep.
Arrhostus, *Reuter*, Hem., 1884.
Arthropleurion, *Goldenberg*, Myr., 1877.
Atrophopalpus, *Townsend*, Dipt., 1892.
Banza, *Walker*, Orth., 1870.
Belostomates, *Schöberlin*, Hem., 1888.
Bematiscus, *Cope*, Mamm., 1892.
Bœhmia, *Hoek*, Pantop., 1888.
Borana, *Dohrn*, Pantop.
Brachinites, *Fritsch*, Col., 1882.
Bradyaphis, *Mordvilko*, Hem., 1895.
Branchiomma, *Claparède*, Verm., 1868.
Calamoptera, *Saussure*, Orth., 1861.
Calanus, *Saussure*, Orth., 1886.
Calligorgia, *Gray*, Cœl.
Capulacmæa, *Sars*, Moll.
Carabocera, *Ganglbauer*, Col., 1889.
Castanella, *Haeckel*, Prot., 1879.
Castanidium, *Haeckel*, Prot., 1879.
Castanissa, *Haeckel*, Prot., 1879.
Castanopsis, *Haeckel*, Prot., 1879.
Cerambycites, *Deichmüller*, Col., 1886.
Ceriodaphnia, *Dana*, Crust., 1847.
Cerosipha, *Guercio*, Hem., 1900.
Chætosoma, *Claparède*, Verm., 1863.
Chamæsipho, *Darwin*, Crust., 1854.
Charnidas, *Stal*, Orth., 1875.
Choanotænia, *Raillet*, Verm.
Chonionotus, *Jordan*, Myr., 1854.
Cicadinella, *Geinitz*, Hem., 1884.
Cimicidium, *Westwood*, Hem., 1854.
Cistelites, *Heer*, Col., 1865.
Clavigerus, *Szépligeti*, Hem., 1883.
Clotenia, *Dohrn*, Pantop.
Colossendeis, *Jarzynsky*, Pantop.
Correbia, *Herrich-Schaeffer*, Lep.
Cosmophyllum, *Blanchard*, Orth., 1852.
Cremodes, *Guenée*, Lep.
Crinodes, *Herrich-Schaeffer*, Lep.
Crithe, *Brady*, Crust., 1874.

Cyclocoris, *Heer*, Hem., 1865.
Cycloderma, *Heer*, Col., 1865.
Cystostylus, *Whitfield*, Prot., 1880.
Davainea, *Blanchard*, Verm.
Decalopoda, *Eights*, Pantop.
Derocardia, *Saussure*, Orth., 1895.
Diacanthodis, *Walker*, Orth., 1870.
Dicæra, *Bell*, Dipt., 1888.
Dicyema, *Kölliker*, Prot.
Dileptus, *Dujardin*, Prot.
Dinophrya, *Bütschli*, Prot.
Diplophyllus, *Saussure*, Orth., 1859.
Dipylidium, *Leuckart*, Verm.
Discoptila, *Pantel*, Orth., 1890.
Dolichoglossus, *Spengel*, Moll., 1893.
Dysepicritus, *Reuter*, Hem., 1884.
Echinoderes, *Dujardin*, Verm., 1851.
Ectotrypa, *Saussure*, Orth., 1874.
Elatobia, *Herrich-Schaeffer*, Lep., 1853.
Eocicada, *Oppenheim*, Hem., 1888.
Epicharmus, *Stal*, Orth., 1875.
Eriococcus, *Targioni*, Hem.
Eriphyla, *Gabb*, Moll.
Euhadrocerus, *Reuter*, Hem., 1884.
Eunemertes, *Vaillant*, Verm., 1890.
Eupagurus, *Brandt*, Crust., 1851.
Eupolia, *Hubrecht*, Verm., 1887.
Euthemisto, *Bovallius*, Crust., 1887.
Fabellovena, *Oppenheim*, Hym., 1885.
Feronites, *Fritsch*, Col., 1884.
Flammulina, *Martens*, Moll., 1873.
Galerucites, *Oppenheim*, Col., 1888.
Gastrostomum, *Siebold*, Verm., 1878.
Geroneura, *Matthew*, Neur., 1889.
Gorgopis, *Menge*, Arachn., 1854.
Grylloderes, *Bolivar*, Orth., 1894.
Gryllomyia, *Seidl*, Orth., 1837.
Gyrinites, *Heer*, Col., 1852.
Hæmodipsa, *Tennent*, Verm.
Haptomerus, *Faust*, Col., 1889.
Hemidina, *Walker*, Orth., 1869.
Hersilioides, *Gourret*, Arachn., 1887.
Heteracis, *Dujardin*, Verm., 1845.
Hilarites, *Heer*, Dipt., 1856.
Homalostomum, *Beneden*, Verm.
Hormomya, *Mörch*, Moll.
Hypselodoris, *Stimpson*, Moll., 1855.
Ischnopoda, *Grandidier*, Orth., 1869.
Kampecaris, *Page*, Myr., 1856.
Karabidion, *Montrouzier*, Orth., 1855.
Lamiites, *Fritsch*, Col., 1888.
Lestoblattina, *Woodward*, Orth., 1887.
Leucotina, *Adams*, Moll., 1860.
Libellulites, *Charpentier*, Neur., 1840.
Libellulium, *Westwood*, Neur., 1854.
Ligyda, *Rafinesque*, Crust.
Limnochares, *Heyden*, Hem., 1862.
Lindia, *Dujardin*, Rot., 1841.
Lionotus, *Wrzesniovsky*, Prot.
Lipomyzon, *Cope*, Pisc., 1881.
Lithoplanes, *Scudder*, Col., 1886.
Lobeza, *Herrich-Schaeffer*, Lep.
Lobophyllus, *Saussure*, Orth., 1859.
Lophonotus, *Menge*, Myr., 1854.
Lophospira, *Whitfield*, Moll.
Lydella, *Dujardin*, Arachn.
Lyttonia, *Waagen*, Brachiop.
Macrostomum, *Schmidt*, Verm.
Mecynostomum, *Beneden*, Verm.
Mengea, *Grote*, Col., 1886.
Mesobætis, *Brauer*, Neur., 1889.
Mesoblattina, *Scudder*, Orth., 1885.
Mesoleuctra, *Brauer*, Neur., 1889.
Mesonemura, *Brauer*, Neur., 1889.
Mesoneta, *Brauer*, Neur., 1889.
Mesopsychoda, *Brauer*, Dipt., 1889.
Metaporcitus, *Costa*, Hem., 1834.
Methylla, *Hansen*, Dipt., 1883.
Micrograllus, *Philippi*, Orth., 1863.
Muceria, *Stal*, Orth., 1878.
Muscaria, *Giebel*, Dipt., 1846.
Myelophilus, *Eichhoff*, Col.
Nanthacia, *Scudder*, Orth., 1890.
Necropsocus, *Scudder*, Neur., 1883.
Nectocarcinus, *Milne-Edwards*, Crust., 1860.
Neocles, *Stal*, Orth., 1875.
Neopallene, *Dohrn*, Pantop.
Newnhamia, *King*, Crust., 1855.
Oenerites, *Oppenheim*, Lep., 1885.
Omalia, *Beneden*, Neur., 1867.
Ommatocarcinus, *White*, Crust., 1852.
Ophryocotyle, *Fries*, Verm.
Opisthophylax, *Menge*, Arachn., 1856.
Orophus, *Saussure*, Orth., 1859.
Orthosolenia, *Reuter*, Hem., 1884.
Oryctites, *Oppenheim*, Col., 1888.
Otiorrhynchites, *Fritsch*, Col., 1882.
Owenia, *Delle Chiaje*, Verm., 1842.
Oxyonyx, *Faust*, Col., 1885.
Pachnepteryx, *Brunner*, Orth., 1865.
Pachymeridium, *Geinitz*, Hem., 1880.
Palæocossus, *Oppenheim*, Lep., 1885.
Palæophlebia, *Brauer*, Neur., 1889.
Palæopsocus, *Kolbe*, Neur., 1883.
Palenarthrus, *Scudder*, Myr., 1890.

Palinostylus, *Bate*, Crust.
Palotta, *Walker*, Orth., 1869.
Panorpidium, *Westwood*, Orth., 1854.
Paradoxoides, *Motschulsky*, Neur., 1851.
Paramaya, *Le Haan*, Crust.
Paranemobius, *Saussure*, Orth., 1877.
Parapleurites, *Redtenbacher*, Orth., 1889.
Parattus, *Scudder*, Arachn., 1882.
Parkeria, *Gabb*, Moll.
Parœcanthus, *Saussure*, Orth., 1859.
Patalene, *Herrich-Schaeffer*, Lep.
Patiscus, *Stal*, Orth., 1877.
Peliopelta, *Uhler*, Hem., 1886.
Peribœa, *Philippi*, Pantop., 1843.
Periphylla, *Steenstrup*, Cœl., 1837.
Petaloptera, *Saussure*, Orth., 1859.
Petaloptila, *Pantel*, Orth., 1890.
Phenacohelix, *Suter*, Moll., 1892.
Philobrya, *Carpenter*, Moll., 1872.
Phlœophthiridium, *V. d. Hoeven*, Hem., 1849.
Phragmatœcites, *Oppenheim*, Hem., 1885.
Phryganeidium, *Westwood*, Neur., 1854.
Phyllobothrium, *Beneden*, Verm., 1849.
Physocypria, *Vávra*, Crust., 1898.
Physoderes, *Westwood*, Hem., 1844.
Pilumnopeus, *Milne-Edwards*, Crust., 1867.
Platyperla, *Brauer*, Neur., 1889.
Primnoëlla, *Gray*, Cœl.
Prionidus, *Uhler*, Hem., 1886.
Procarabus, *Oppenheim*, Col., 1888.
Prodytiscus, *Oppenheim*, Col., 1888.
Progeotrypes, *Oppenheim*, Col., 1888.
Prolystra, *Oppenheim*, Hem., 1888.
Prorhynchus, *Schultze*, Verm., 1851.
Proscorpius, *Whitfield*, Arachn., 1885.
Pteromus, *Serres*, Hym., 1829.
Ptychodon, *Ancey*, Moll., 1888.
Rhabdogaster, *Metschnikoff*, Verm., 1866.
Rhapha, *Giebel*, Neur., 1856.
Rhaphidium, *Westwood*, Neur., 1854.
Rhipidorrhabdus, *Oppenheim*, Hym., 1885.
Rhizocera, *Kirk*, Hem., 1897.
Rhizomaria, *Hartig*, Hem., 1857.
Rhizophthiridium, *V. de Hoeven*, Hem., 1849.
Rhombogaster, *Dallas*, Hem., 1852.
Rhynchothorax, *Costa*, Pantop., 1861.
Saccocirrhus, *Bobretzky*, Verm., 1871.
Sanna, *Walker*, Orth., 1870.
Saurita, *Herrich-Schaeffer*, Lep.
Sciobia, *Burmeister*, Orth., 1838.
Seniaulus, *Heyden*, Col., 1866.
Sialium, *Westwood*, Orth., 1854.
Silphites, *Fritsch*, Col., 1882.
Siphonosphæra, *Müller*, Prot., 1858.
Solenopus, *Sars*, Moll.
Spongioderma, *Kölliker*, Cœl.
Stenophylla, *Westwood*, Orth., 1845.
Stictosynechia, *Reuter*, Hem., 1884.
Stylarioides, *Claparède*, Verm., 1868.
Subcallipterus, *Mordvilko*, Hem., 1894.
Sybriacosoma, *Jacoby*, Col., 1895.
Symydobius, *Mordvilko*, Hem., 1895.
Synagoga, *Norman*, Crust.
Syntomaptera, *Tepper*, Orth., 1893.
Systenocerus, *Weise*, Col.
Tedla, *Walker*, Orth., 1869.
Tethneus, *Scudder*, Arachn., 1882.
Theramenes, *Stal*, Orth., 1875.
Timarchopsis, *Ganglbauer*, Col., 1889.
Tineites, *Germar*, Neur., 1843.
Tineites, *Kawall*, Lep., 1876.
Tivia, *Walker*, Orth., 1869.
Tricala, *Walker*, Orth., 1869.
Trichopteridium, *Geinitz*, Neur., 1880.
Trigænes, *Dohrn*, Pantop.
Triodonta, *Williston*, Dipt., 1885.
Tristichochæta, *Panceri*, Verm., 1878.
Trocnada, *Walker*, Hem., 1858.
Ululodes, *Currie*, Neur., 1899.
Uronema, *Dujardin*, Prot.
Velenovskya, *Fritsch*, Col., 1888.
Wollastoniella, *Reuter*, Hem., 1884.
Wollastonites, *Heer*, Col., 1865.
Xerampelus, *Guercio*, Hem., 1900.
Xestops, *Cope*, Rept.
Zalmona, *Giebel*, Neur., 1856.

Corrections.

Page 24, *for* Anthracothemma *read* Anthracothremma.
,, 32, *for* Aristocarabus, *Reitter*, *read* Aristocarabus, *Semenov*.
,, 50, *for* Brachycerus, *Olivier*, 1889, *read* 1789.
,, 52, *for* Brontes, *Kugelann*, 1898, *read* 1798.
,, 79, *omit* Clopterocoris; it is recorded correctly on the same page as Closterocoris.
,, 86, *omit* Cordolydon; it is recorded correctly on the same page as Cordylodon.
,, 97, *for* Cyrtodisea *read* Cyrtodisca.
,, 103, *for* Dermestoides, *Herbst*, 1883, *read* 1783.
,, 120, *for* Elasmocerus *read* Elasmocera; *for* Elateroides, *Schneider*, 1892, *read* 1792.
,, 125, *omit* Epactius; it is a *nomen nudum*.
,, 131, *for* Eucalypta *read* Encalypta.
,, 196, *for* Leptocala *read* Leptocola.
,, 209, *for* Macrosiphum, *Œstlund*, 1886, *read* Macrosiphum, *Passerini*, 1860.
,, 303, *omit* Probiscidoris; it is recorded correctly on the same page as Proboscidocoris.
,, 326, *for* Rhaphidochila, *Kerremans*, *read* Rhaphidochila, *Jakovleff*.

Corrections to Waterhouse's 'Supplementary List' (London, 1904).

Page 4, *for* Chrondropsis *read* Chondropsis.
,, 6, *for* Hydropomorpha *read* Hydroporomorpha.

Corrections to Scudder's 'Nomenclator.'

Page 98, *for* Didynaozoon *read* Didymozoon.
,, 174, *for* Leucastra *read* Lucastea.
,, 195, *for* Metoponia, *Guenée*, 1852, *read* Metoponia, *Duponchel*, 1844.
,, 208, *for* Nemobia *read* Nemobius.
,, 326, *for* Tridactylus, *Latreille*, 1807, *read* Tridactylus, *Olivier*, 1789.

IS THE OKAPI IDENTICAL WITH THE "THAHASH" OF THE JEWS?

By S. M. Perlmann.

Quite recently the January number (1904) of the 'Westermannsche Monatshefte' first reached my hands. My attention was at once drawn to an article by Georg Krause entitled "The Okapi; an Animal newly discovered in the Primitive Forests of Africa." As I had formerly read with interest in different newspapers some short notes and remarks regarding this new mammal, I attentively perused this publication, and became more convinced of what I had surmised long since, namely, that this animal, which is new with us, was already known to the Jews at the time of Moses under the name of "Thahash."

I consider my suggestion a probable one, but I fear I am very late (*post festum*) with it, and it would be very curious if nobody had thought of it till now; but, regardless of being too late, I will not shrink from compiling the arguments on which I base my views.

Before quoting the sources on which my suggestion is based, I consider it necessary to give some quotations from the article on the Okapi by Krause. There it is said (p. 465): "... Their [the aborigines'] information and scanty narratives were generally limited to the description of the Okapi as a zebra-like creature with a dark brown upper part of the body, and it has more than one hoof." Further (p. 466): "Now it became apparent that the Okapi is not a horse but a ruminating animal." And (p. 467): "The most interesting part of the skull of the Okapi, after all, is the forehead. There are three elevated spots to be perceived distinctly; two of them on those places where other animals have the horns, and the third one between the eyes, at the very centre of the root of the nose."

I will now adduce my arguments for the view that this animal is the same as is called in the Bible (Exod. xxv. 5, and

xxxv. 7) by the name "Thahash," and that the Talmudists most probably knew by tradition more or less about the qualities and conditions of the Okapi.

It is said (Exodus xxv. 3–5): "And this is the offering which ye shall take of them; gold, and silver, and brass, and blue, and purple, and scarlet, and fine linen, and goats' hair. And rams' skins dyed red, and 'Thahash' skins, and shittim wood." Luther and almost all Christian translators of the Bible translate the word "Thahash" by "Badger" (see notes by Kitto to the 'Illustrated Family Bible'; see also James Inglis's 'Bible Text Cyclopædia' and John Endre's 'Dictionary of the Holy Bible'); whereas most Hebrew translators left the word untranslated in due deference to the Talmudists, paying full attention to the doubts expressed by them in the Talmud. What really is to be understood by "Thahash"? The renowned Bible commentator "Rashi" has abstained in both verses in Exodus from giving any explanation whatever for the word; he merely quoted the Talmud: "This animal existed only at that time," or, to express the meaning of the Talmud more properly, "the animal existed only for that time and for this special purpose, namely, to be used as a cover at the Tabernacle."

We find the animal "Thahash" mentioned once more by the prophet Ezekiel (xvi. 10), "Vaenahlekh Thahash," and there it is translated by the same commentator, "Rashi," by "calzaite Taisson." But there is some reason for supposing that this translation does not originate from "Rashi," but was adopted from a marginal note, and it proceeds from the "Goluth Yehudah" (Venetia, 1612), by the Italian scholar, Leon Modena, who translated "Thahash" by "calzaited Tasso," as "Rashi" never contradicts himself, and never deviates from an interpretation once acknowledged by him as correct. Gesenius gives three translations for "Thahash": one as meaning to denote the colour of the skin (as the Septuagint and Vulgate take it in translating by "hyacinth colour"), being something like the colour of a dolphin; the second translation denoting the tanning and finishing of the skin, meaning "morocco-like"; and the third translation, to which Gesenius is inclined to agree, is an animal named "Thahash," and to be translated by "Badger" or "Dolphin." In the 'Encyclopædia Biblica,' edited by Canon Cheyne

and Dr. Sutherland Black, besides the same translations as quoted by Gesenius, there are other ones, *viz.* sub 4, that "Thahash" means "Thaish" (Ram = he-Goat), which is considered by the editors as "less probable," because rams' skins, dyed red, are separately mentioned in the same verse under the name "alim"; and sub 5, what the editors consider as "most probable," is to be translated by "Egyptian leather." I cannot see the probability of this translation; it could be well applied in Ezekiel xvi. 10, in connection with "Vaenahlekh," which means, "I will attire ye with shoes of Thahash," but never could be applied in Exodus in connection with the word "oroth," which means "skins," and proves that the word "Thahash" connected with it means the name of the animal whereof the skin comes, like "oroth alim," meaning "skins of rams." The 'Jewish Encyclopædia' is inclined to take it as "wether skins," but I fully agree with the 'Encyclopædia Biblica' and call this translation "less probable," for the reasons mentioned.

I will now quote the descriptions of "Thahash" by the Talmud, and thus it will be seen that the "Okapi" is probably identical with the "Thahash" of the Bible.

'Talmud-Bably, Tractat Sabbath,' 23 *a*: Rabbi Joseph, answering the question put before him whether the "Thahash" which was living at the time of Moses (*i. e.* an animal not known afterwards) was a clean or unclean one, says: "As to it, there cannot be even a question raised, as we are taught elsewhere that only skins coming from clean animals were permitted to be used for things destined for holy purposes."* This answer was objected to for the following reason: Rabbi Nehemiah has said, "There was in the Tabernacle one cover alike to 'Tala-elon' or 'Kala-elon' (which means 'Weasel' or 'Marten'), and these animals certainly are unclean ones; wherefore the explanatory answer from Rabbi Joseph, 'The cover only resembles in colour the said animals, but not the very skins of these unclean ones.'" To this Rabbi Joseph added: "Accordingly, the translation of 'Onkoloss' of the word 'Thahash' by 'Sossgavna' is to be understood as of an 'enchanting colour.'" Further, 'Talmud-

* Clean animals are to be discriminated from unclean ones by the following marks: "Whatsoever parteth the hoof, and is cloven-footed, and cheweth the cud, among the beasts, that shall ye eat" (Leviticus xi. 3).

Bably, Tractat Sabbath,' 28 *b*: Rabbi Myer said, "The animal 'Thahash,' which lived at the time of Moses, was of a particular species, and the scientists were unable to decide whether it was a species of cattle or of wild beast. It had *one horn on its forehead.* It was discovered by Moses at that time. Moses had used its skin for the Tabernacle, and it disappeared afterwards." In 'Talmud-Jerusalmy, Tractat Sabbath,' p. 18, we find the following discussion: "What is to be understood by 'Thahash'? Rabbi Yehudah said 'Tainun'; it means the colour of the cover. Rabbi Nehemiah said 'Galaktania,' *i. e.* 'Weasel' or 'Marten,' of the skins of which the cover was made. All other Rabbis said it meant the name of the animal, and a clean animal." In 'Midrass Tanhoumah' (portion Troumah) we read: "Rabbi Yehudah said the 'Thahash' belonged to the section of clean animals; it was a big animal of the steppe, and had *one horn on its forehead*, and its skin was of six colours." It is evident that this Rabbi takes the translation of "Onkoloss" by "Sossgavna" as "sess" (six) "gavna" (colours). Rabbi Nehemiah said: "This animal was a miraculous creature; it was purposely created for the adornment of the Tabernacle, and as soon as its calling was fulfilled it was taken from the world." In 'Midrasz Koheleth' (paragraph 80) we find the following: "What is to be understood by 'Thahash'? Rabbi Yehudah said: 'Altania' (blue coloured); Rabbi Nehemiah said: 'Glaktania' (Weasel or Marten)."

From all this it is evident that the Talmudists, relying on traditions and religious precepts, considered the "Thahash" to be a clean animal—*i. e.* a ruminating one—with parted hoofs, and that it was of a beautiful colour and had one horn on its forehead. All these marks are found again on the recently rediscovered "Okapi," although it had since that time disappeared.

I add some remarks in my correspondence with the zoologist, Georg Krause, of Berlin:—I am sure that the Commentators who took "Thahash" (plural "Thoshim") as describing a certain colour (among them the Septuagint, the Vulgate, and Josephus, Antiq. iii. vi. i.) have erred like the others who translated it by "Badger" (Luther and most others),* or by "Dolphin" (Dr.

* It is worthy to be noted that Luther translated "Thahash" in Exodus xxv. 5, by "Badger," and in Exekiel xvi. 10, by "morocco."

Julius Fuerst). The first translation (colour) is against the Hebrew grammar; if colour was meant it ought to be said "oroth metokhoshim," instead of "oroth Thoshim," like "oroth alim modomin," and in Ezekiel xvi. 10 it is quite unthinkable to take "Thahash" as a colour; and therefore those Commentators who strictly keep to the grammar, *e.g.* "Rashi" and "Eben-Ezra," have left the word untranslated, restricting themselves to the statement "Thahash" was an animal known at that time. The second translation, "Badger" or "Dolphin," is decidedly against the Jewish religious spirit of the time when the Tabernacle was erected. It would be preposterous to admit that Moses, at the same time when he dictated the severe precepts of "clean" and "unclean," should have chosen skins of unclean animals for the adornment of the Holy Tabernacle of God.

As a final and authoritative argument, I take the characters which are found alike in the "Okapi" as well as in the "Thahash"; they are both "ruminating," "parted hoofs" (which mark both as clean animals), and have a "horn-like elevation at the root of the nose" (which induced the Talmudists to speak of one horn)* "and the enchanting colour of the skin." There is no doubt that the "Thahash" was of a beautiful colour, otherwise its skin would have been dyed and coloured for beauty, as the rams' skins were dyed red (Exod. xxv. 5).

* And the imagination was used to construct "only one horn" of the elevation between the eyes, and to make the miraculous "Thahash" somewhat resemble the legendary miraculous bull, who was the first sacrifice of Adam. Of this bull, Rabbi Yehudah ('Talmud-Bably, Tractat Sabbath,' p. 28*b*), interpreting a verse in Psalm lxix., says, "The bull which was the first sacrifice of Adam had only one horn on his forehead."

NOTES AND OBSERVATIONS MADE DURING A CRUISE TO THE EAST ON BOARD THE 'VALHALLA' R. Y. S., 1907–1908.

By Geoffrey Meade-Waldo, B.A., F.E.S.

I had the good fortune to receive an invitation to accompany Lord Crawford on his magnificent yacht, the 'Valhalla,' on a cruise to the Far East during the past winter, and it is hoped that a few remarks on things collected or observed may not be without interest.

In 'Three Voyages of a Naturalist,' by Mr. M. J. Nicoll, all that is necessary to explain the reason for such a prolonged cruise will be found; also a full description of the yacht herself. In the event, however, of there being readers who have not had the opportunity of seeing the book, I will briefly give the details. The 'Valhalla' is a full-rigged ship, and is in that respect unique among yachts; she is fitted with auxiliary and steam-power capable of a good average ten knots per hour. Her tonnage is 1490 tons, and, needless to say, she is fitted out in the most comfortable fashion, and is the *beau ideal* of a ship for cruising in the Tropics.

I joined the yacht at Cowes on Nov. 8th, but partly on account of a dense fog we were kept there until the 12th, and we did not actually leave the English coast until the 15th, being forced into Dartmouth and Falmouth before we were able to cross to Ushant.

I will now give briefly the extent of our cruise before going into details of any one place:—

Gibraltar, Nov. 19th–21st; Port Said, Nov. 29th; Cairo, Nov. 30th–Dec. 3rd; Aden, Dec. 11th–13th; Ceylon (Colombo), Dec. 24th–29th; Kandy, Dec. 29th–Jan. 3rd, 1908; Trincomalee, Jan. 8th–13th; Pulo Way, North Sumatra, Jan. 23rd; Singapore, Jan. 26th–31st; Johore, Feb. 1st–3rd; Borneo (Sarawak), Feb. 11th–14th. Malay Peninsula: Malacca, Feb.

18th; Port Dixon, Feb. 19th; Port Swettenham (expedition to Kwala Lumpur and Semangko Gap), Feb. 20th–23rd; Penang, Feb. 24th–25th; Pulo Way, Feb. 27th–March 3rd; Colombo, March 7th–12th; Aden, March 20th–21st; Suez, March 26th.

After entering the Mediterranean we went to Naples, and after a short stay there cruised to the Riviera, eventually getting to Gibraltar on April 26th, and to Cowes on May 3rd.

The greater part of the time available in port I spent in collecting insects. By this means a good number of specimens were obtained, including species of Lepidoptera, Hymenoptera, Diptera, Orthoptera, Coleoptera, Heteroptera, and Homoptera, the two first-named groups forming the bulk of the collection.

It is only natural that, when landing for the first time in a tropical country, one should feel quite overpowered by the wealth of life in every form, the consequence being that many objects of the greatest interest either pass unnoticed, or else, if noticed, only in the most perfunctory manner. It is entirely otherwise at sea, where almost everything that alights on board can be either captured or observed, and some creatures, seemingly of feeble flight, boarded us at considerable distances from the shore. Thus, a moth of the "Thorn" family and a "Snout" were seen on board far out at sea off the Algerian coast on Nov. 25th. A dragonfly, two small moths, two locusts, and a beetle joined us in the Red Sea, and when still over one hundred miles from Colombo a "Skipper" butterfly came on board. When rounding Dronga Head a butterfly (*Belenois taprobana*) appeared on deck, and again, when we were quite four hundred miles from Ceylon *en route* for Pulo Way, a Sphingid moth (*Chærocampa theylia*) was captured. In the Straits of Malacca I had quite an exciting evening (Jan. 25th), quite a number of large Cicadas boarding us and making a great noise as they flew up against the deck-awnings; two species of *Macroglossa* and other moths also came on board that evening, as well as a large beetle. We also had visits from birds—Larks, Chaffinches, and a Starling accompanying us in the Mediterranean to Port Said—and quite a number of spring migrants joining us on the journey home. House-Sparrows came on board when we were rounding Ushant, quite forty miles from land, on May 1st.

It would be tedious to go through the numerous delightful

excursions made during the cruise, for there were many such, but some account of our stay in Ceylon may be interesting. The first thing to attract the notice of a naturalist would assuredly be the number of Crows (*Corvus splendens*) and Brahmini Kites in Colombo Harbour. They are both invaluable scavengers, and consequently nobody thinks of disturbing them. The tameness of the Crows was extraordinary, and the ship's cat had a most tantalizing time with them, as they did everything but allow him to catch them. I never saw a Kite perched in the rigging, though they were constantly round the ship. The Crows would sit anywhere and everywhere.

From Colombo I made my first excursion into the jungle, accompanied by one of the sailors, a most interesting and helpful companion. I caught an early train to a place called Padukka, some twenty-five miles from Colombo, and from there we proceeded in a bullock-hackory towards Labugama, where are the reservoirs containing the water-supply for Colombo. The first thing of note was a large Rat-Snake, lazily sunning itself; they also are protected by the natives, being great destroyers of vermin.

Butterflies and a few day-flying moths were to be seen, among the butterflies the most noticeable being the stately *Ornithoptera darsius*, but they were flying at a great height, and were quite unapproachable. Many fine species were captured, including some beautiful members of the "Blue" family. Large arboreal wasp-nests were common, and many termite mounds were to be seen.

The well-known scarcity of life during the heat of the day in tropical countries was most emphatically manifested here—not a butterfly in the sun, and only a few on the wing seeking resting-places in the dense jungle—not a bird on the move; all retire till the burn of the midday sun has lessened.

We returned in time for dinner, and on changing my clothes I found several well-filled leeches adhering to my person, but have not suffered any discomfort from their presence. It was at this same place that I noticed a curious phenomenon on our return journey in March. A certain handsome day-flying moth (*Dichromia orosia*) was to be seen commonly among the thin scrub beneath the palm trees, but its flight was very erratic and

swift, making it almost impossible to capture. I then stood still for some time watching them, and noticed that every time they came to a palm tree they circled round and round the stem, mounting all the while, till an altitude of some fifteen or twenty feet was reached, and then reversing the action almost to the ground, when they would start off again on their mad flight until another palm tree appeared in the course, and then the same thing happened. By standing at the foot of a tree in a main line of flight I caught a number without any difficulty, though previously I had been unable to catch any.

We had a delightful visit to Kandy, the difference in elevation making a most noticeable change in the fauna. Kandy is a fine centre for collecting, the walks in the immediate neighbourhood are good, Lady Horton's Walk in particular being productive of fine "stick-insects" and "mantids," including the curious cobra-mantis. I visited this walk with a lantern one evening, and caught a number of moths, and was much struck by the number of flying phosphorescent insects which presented a most curious spectacle among the trees. On another occasion we went to a place called Haragama, about nine miles from Kandy, and situated near a fine river, a locality which is always good for insects, and on this river-bed we had very good reason to congratulate ourselves. Several large Sphingid moths (*Acherontia lachesis*) were poked out of the crevices of a gigantic banyan tree, and some magnificent Buprestid beetles were sunning themselves on another tree. Several species of larvæ were collected, including those of *Doleschallia basaltide*, one of the "leaf" butterflies, and *Talicada nyseus*, a very pretty little Lycænid butterfly, abundant round Kandy. The larva of this butterfly constructs quite a cocoon for its pupa.

From Kandy we all returned to Colombo to join the 'Valhalla' for a trip to Trincomalee. This place is indeed a naturalist's paradise, having, as it has, good collecting ground up to the water's edge. I noticed two things in particular at Trincomalee—one was the much smaller number of individual butterflies, though there was no apparent diminution in point of species; the other was the extreme abundance of *Menelaides hector* as compared with the western side of the island, where *Lærtias romulus* was much the commoner insect, though I only

saw an odd specimen at Trincomalee. *M. hector* swarmed all over the water as well as land, all, or nearly all, in fresh condition, and nearly all of them males. On an island in the fine harbour I managed at last to catch *Ornithoptera darsius* (male and female). The island proved a first-rate locality for many things, and especially Hymenoptera. We had here several comparatively unsuccessful hauls with the seine-net, but, as we were under the guidance of a native, it is more than probable that we were not shown the best localities. Fish were extremely abundant, and any morning one could see the native fishermen returning with well-filled baskets, containing everything from the Hammer-headed Shark to a fish no larger than a whitebait.

We returned to Colombo before proceeding further East, and after remaining a short time there started for Singapore, with a stop at Pulo Way, an island off North Sumatra, for coal *en route*. This island is a Dutch possession, and the coaling company a private one; the same company owns the floating-dock, into which we went on our return journey. This enabled us to spend several days on shore, and a number of nice captures were made. The common *Danais chrysippus*, most cosmopolitan of butterflies, and a species of *Euplœa* were in countless numbers along by the sea, many of them sitting on the wet sand. Many coloured fish of every kind were swarming round the dock, and Sharks were plentiful in the harbour. We made an expedition to the mainland one day by the small local steamer, which takes about three and a half hours to do the crossing, following close in under the island for the first hour or so, a most interesting looking place. There were some fine Turtles swimming about in the vividly clear water. Oleleh, the port for Kota Raja, the capital of Achin, is not an interesting place, but Kota Raja itself is a nice little town right under the mountains in which the discontented Achinese dwell. Butterflies did not seem numerous, but moths were flying at some flower-beds in the public garden, amongst them *Chærocampa celerio*. The Sumatran Toad is apparently a very sophisticated creature, and we were much amused at the behaviour of certain individuals. The verandah where we sat after dinner was tenanted by several of them, each stationed under a lamp, and making a hearty meal off the insects

which fell to the ground after burning their wings or otherwise damaging themselves. It was interesting to note that a newcomer was instantly driven away by the old tenant, and had to wait about some distance away on the chance of something eluding his more happily placed rival. Moths and some nocturnal wasps of the genus *Dorylus* formed the majority of victims, and we saw one Toad eat at least a dozen wasps in a very short time.

After a short stay in Singapore, the next port of call, and a most delightful cruise round the island to Johore, we left on Feb. 8th for Borneo. We arrived at the mouth of the Sarawak River about noon on the 10th, but were unable to go up that day as the tide was low, so started up the following morning about ten o'clock, and thus had the scenery quite at its best. The nipa palm (than which, I believe, no finer palm exists, if size of frond is any criterion) and the mangrove were easily first in point of number, and there were several decaying tree-trunks covered with masses of orchids, many of them in full bloom. We anchored some miles below Kuching, the capital, the reason for this being that we should probably have difficulty in turning round further up. That evening many Monkeys came down to drink and wash by the river, bringing some quite young ones with them; they were no other than the curious Proboscis Monkey, which feeds on plants and roots growing in the mud. Another species of Monkey was common in the forest, and I saw several troops of them the following day. We were unfortunately unable to remain for long in this interesting place, and after calling again at Singapore, where I obtained two young Orang-utans, quite newly caught, we started up the Straits of Malacca, calling at several places on our way.

The yacht lay at anchor in the Klang River of Selangor, while I made an expedition to the central range of mountains, stopping in the Government rest-house at Semangko Gap. This place is at a considerable elevation, and the rest-house itself is on the very boundary between Selangor and Pahang, the division of the watershed being in the garden of the rest-house. The glorious scenery and wealth of life will ever live in my memory, and I am glad to think that I was able to make the most of my short visit, thanks to Mr. H. C. Robinson, of the Kwala Lumpur

Museum, who was also stopping in the house, and put his great local knowledge at my disposal. Cicadas making weird noises like penny trumpets, Pigeons "booming," and the melodious cry of the "Wa-wa," or Gibbon, were a few of the sounds to be heard.

On rejoining the yacht we started off to Penang, where the heat was intense. A short stay only was made there, and then on to Pulo Way, and so to Colombo, after which the trip, so far as collecting was concerned, was a thing of the past.

I regret to have to state that both the Orangs died before reaching Cowes, though one of them lived until Gibraltar was passed; but a charming little Gibbon, which Lord Crawford obtained in Borneo, came triumphantly through the changes of temperature, and is now in the Zoological Gardens, and in the very best of health.

NOTES AND QUERIES.

MAMMALIA.

Occurrence of the Grey Seal (Halichœrus grypus) in the Mersey.—An adult male Grey Seal was shot in Paddington Lock, on the Woolston New Cut of the River Mersey, over two miles, by the river, above Warrington Bridge. It was driven into the lock and killed on June 17th, 1908. For two or three days before it was killed two Seals had been noticed between Atherston Quay and Warrington Bridge, and several unsuccessful attempts were made to shoot them. In order to reach the Cut the Seal must have ascended Howley Weir, Latchford, which it probably did at high tide. The animal, which I examined in the flesh, measured :—From nose to tip of tail, 7 ft. 6 in.; from nose to longest toe of hind foot, 8 ft.; length of fore flipper, 14 in.; length of index toe-nail, 2½ in.; girth of body posterior to fore flippers, 4 ft. 8 in.; length of head, 14 in.; length of incisor teeth, ¾ in.; length of hind flipper, 15 in.; width of hind flipper, 18 in.; length of tail, 7 in. The teeth were not crowded, nor were they distinctly tuberculated; the nasal opening was typically large. Mr. T. A. Coward has seen the skin and skull, and confirms the identification; he has seen the Grey Seal off the coasts of Lleyn and Anglesey, where it has occurred on several occasions, and is of opinion that the species may breed on the North Wales coast. This is the second recorded instance of the occurrence of the Grey Seal in the Mersey, the previous one being in the winter of 1860–61, when one was captured in the Canada Dock, Liverpool (Proc. Liv. Lit. & Phil. Soc. xv. p. 134, 1860–61; Proc. Liv. Biol. Soc. iii. p. 263, 1888–9). The present specimen has been obtained for the Warrington Museum.—G. A. Dunlop (Warrington Municipal Museum).

AVES.

Mimicking Song of Chiffchaff.—It may interest your correspondent, Col. H. Meyrick, to know that when at Bettws-y-Coed in April, 1905, I heard a very similar "combined" song. The bird began with a normal "chiffchaff," three or four times repeated, then suddenly

broke off into the Willow-Wren's descending scale, but always, before this was completed, the bird returned to the Chiffchaff's note, again three or four times repeated. It did this many times, but unfortunately I was unable to tell definitely whether it was a Chiffchaff or Willow-Wren, as it was up in the top of a tall willow tree. Could it possibly be due to intercrossing of the two species? The curious thing both about this bird and that observed by Col. Meyrick is that this combined song, if I may so call it, though slightly different in the two cases, was always repeated in exactly the same way. This seems to show that it was due not to any mimicking power but to some inherent peculiarity, such as might be produced by intercrossing.—J. S. Huxley (Balliol College, Oxford).

Muscicapa atricapilla in Ireland.—In Mr. E. P. Butterfield's interesting notes on the Pied Flycatcher (*ante*, p. 223) he says:—"It is locally common in some parts of Wales, and the same remarks are applicable to Yorkshire and Westmorland, but further north it becomes more scarce; whilst in Scotland it is a scarce breeding species, and in Ireland, where it was first recorded in 1875, it is still more so." In order to correct this misstatement of its breeding in Ireland, I beg to refer Mr. Butterfield to the 'Birds of Ireland,' where he will find that the bird has never been found breeding in this country; and since I obtained the first recorded specimen in April, 1875, only six others have been obtained, and all by my friend Mr. R. M. Barrington from lighthouse stations on the coasts of Kerry, Cork, and Wexford during the autumn migration.—Robert Warren (Moy View, Ballina).

Ortolan Bunting at Plaistow, E.—I have much pleasure in recording a male Ortolan Bunting (*Emberiza hortulana*). It is in fine adult plumage, and was obtained by Mr. R. M. Presland, George Terrace, Beckton Park, on May 6th, 1908. I have had it preserved by Mr. E. Houghton, naturalist, Shrubland Grove, Dalston. I also wish to record a male specimen of the Woodchat-Shrike (*Lanius pomeranus*). It was shot at Camber, near Rye, by Mr. Thomas Sorrell, of Hastings, Sept. 15th, 1907.—J. A. Clark (57, Weston Park, Crouch End, N.).

Cypselus melba at Lynmouth, North Devon.—My brother and I recently saw an Alpine Swift, between seven and eight p.m. It was flying at a low altitude over our house, flew along the sea-wall, and returned back over our heads; so we distinctly saw the grey under side. Our attention was drawn to it in the first instance by its size. There was a good deal of sea-fog at the time, and apparently it had lost its way.—T. H. Briggs (Rock House, Lynmouth).

Cuckoo's Eggs.—During a hurried visit which I paid to Mr. Thomas Jackson, 'Ship Hotel,' Overton, near Morecambe, on June 16th, he informed me that two Cuckoo's eggs had recently been found in the nest of a Meadow-Pipit, but with no eggs of the owner at the time these were found. One, however, was subsequently laid. He also let me see a Cuckoo's egg which had recently been found in the nest of a Sky-Lark built in the churchyard, and told me he has found the Cuckoo's egg in the nest of Greenfinch and Linnet, and also in the Ray's, Pied, and Grey Wagtail, Grasshopper- and Reed-Warbler, Tree-Pipit, Robin, and Redstart. He further informed me that during a forty years' experience of bird's-nesting he had never found a Cuckoo's egg in the nest of a Hedge-Sparrow, which coincides exactly with my experience in this district. Although the Whinchat is by no means scarce in the Overton district, Mr. Jackson knows of no instance of this species having been selected as fosterer, thus differing in this respect from many districts.—E. P. Butterfield (Bank House, Wilsden).

Peregrine Falcons and Buzzards in Cornwall.—During May and June I spent some of my leave in Cornwall, and went to my usual bird haunts. I am very pleased to be able to say that our two largest birds of prey keep up their numbers; in fact, the Buzzard is almost certainly increasing. I have visited two Peregrines' eyries, and have heard of two more, whilst a fifth couple had mated, but the male was shot by a well-known West Country farmer. In the spring of this year also two Falcons were [illegible] near . . . . by two local farmers within a short time of each other. The former bird shot was evidently a male, as on Sunday I saw the remaining bird alone, a very fine one, and, judging by size, a female. A resident also told me the bird has always been seen alone since the shooting affair, so she has evidently failed to find a mate. On June 14th I visited an eyrie which defied the efforts of some fishermen (so one told me) to get at the eggs. The Falcon flew out, screaming loudly. A pair of Buzzards were circling round at the time; one was immediately flown at by the Peregrine, and there was a very real collision. The larger bird stopped wailing, and flew away with all speed. Peregrines—especially the male bird—in stooping to Buzzards, generally avoid coming in contact by swooping above just without touching. Two of the eyries I consider safe now, as very few people know anything about them, but three eggs were taken by some fishermen from a more accessible nest. The usual price is five shillings each egg. Four were sold to a man two years ago for £1, and four more

were obtained just after he left. I have never known so many Peregrines nesting before. It is remarkable how they keep near the same locality year after year, though not the exact spot, doubtless owing to persecution. The pair I visited on the 14th had their eggs taken (four in number) last year, but through building about one hundred yards away this year are secure from egg-stealers. I know of two pairs of Buzzards building in woods, one wood being very small indeed. They have built in the same wood for about seven or eight years, but in the larger wood this is the first time. I climbed up to one, and found two very young birds and one egg unhatched in the middle of May. The remains of a rabbit were at the side of the nest. I have climbed up to the three different nests built by these birds during the above years many times, and have invariably found some portion of a rabbit in the nest. During this spring most of the tall trees in this wood have been cut down, including the one they built on last year, and now there are not more than three trees of sufficient size for the big birds to build upon. They have chosen one standing by itself. During this spring I have seen at least a dozen pairs of Buzzards. Many of their nests are inaccessible, so there is no likelihood of the bird being exterminated in Cornwall for many a long day to come. This is more than can be said of the much rarer Peregrine, both because of the destruction they do amongst the chickens and the keen demand for their eggs. Peregrines are distinguished as "Blue Hawks" by the local people, whilst Buzzards are called "Kits." Few sights give me so much pleasure as watching a pair of Peregrines. What marvellous powers of flight! They often stoop to Buzzards, their object being to drive them away, and will constantly fly at them till this result has been achieved. — H. P. O. Cleave (18, Leigham Street, Plymouth).

The "Drumming" of the Snipe. — In his valuable paper on the "bleating" or "drumming" of the Snipe, published in a late number of the 'Proceedings of the Zoological Society,' Mr. P. H. Bahr relates his observation, believing it to be new, that during the "bleating" the two outer tail-feathers are spread well in front of the other twelve so as to stand quite apart from them, and comes to the conclusion that by this means the "drumming" is produced. Perhaps I may be allowed to point out that I made a precisely similar observation many years ago (June, 1889) in Selkirkshire, and in a note sent to this Journal at the time (Zool. 1889, p. 315) recording the fact, suggested that it might have to do with the production of the sound. A sketch of the "drumming" Snipe which I made on the

spot agrees perfectly with Mr. Bahr's illustration. — WILLIAM EVANS (38, Morningside Park, Edinburgh).

Some Rare Kentish Birds. — It may perhaps be of interest to chronicle the facts relating to the Little Bustard (*Otis tetrax*) killed in the Isle of Thanet in 1902, as I do not think full details have ever been published. For about a fortnight prior to its death this bird was frequently observed in some fields adjoining Stone House School, Broadstairs, remaining in that district in spite of its being sadly persecuted by local sportsmen. On or about Dec. 20th, while shooting, Mr. Thomas Pemble happened to flush the Little Bustard from a field of swedes, and as it rose well within shot it was promptly killed. The specimen is still in Mr. Pemble's possession, where I have examined it. On Feb. 23rd of this year Mr. Wise shot a Fulmar (*Fulmarus glacialis*) off Kingsgate. This Petrel is extremely rare on the coasts of Thanet, and this is the first occurrence known to me. About a week or so earlier the same gentleman secured a Hen-Harrier (*Circus cyaneus*) in the livery of an immature male, also, I believe, from the neighbourhood of Kingsgate. From time to time Hoopoes (*Upupa epops*) are seen in Thanet, usually in the spring, and were they not almost invariably killed (for their peculiarly conspicuous plumage gives them practically no chance of escape) they would probably remain to breed. This spring one was seen in different private gardens round Westgate for about three weeks, but has now unfortunately disappeared, although I have not heard of it being shot.— COLLINGWOOD INGRAM (Westgate-on-Sea).

Birds which do not usually Perch.—When leaving Overton I crossed the fields to Morecambe, and whilst walking alongside a ditch I saw a Sky-Lark perched on a sallow tree, and when flushed off by my near approach it immediately settled on another sallow. I have never before seen this species perch on trees, except once on the Sussex coast near Hastings a few years ago, and once in this district we had one which had a nest near Bingley Wood, and frequently alighted on the top of a thorn-hedge previous to feeding its young. Soon after the arrival of the Wheatear this year I saw one perched on the top of a thorn-hedge, which is not a common occurrence here, and when walking over Stainburn Moor, near Harrogate, on June 10th, a Snipe was perched on one of the arms of the telegraph-posts, calling to its mate for a considerable time. I have known odd individuals of the Common Sandpiper perch with great facility in their nesting haunts when intruders are about their nests, or, even more, their young.— E. P. BUTTERFIELD (Bank House, Wilsden).

NOTICES OF NEW BOOKS.

The Senses of Insects. By Auguste Forel. Translated by Macleod Yearsley, F.R.C.S. Methuen & Co.

This is a far more important publication than its title implies. It can in no sense be accepted as a purely entomological treatise, for it raises the primary question in animal psychology. Are instinct and reason distinct entities, or are they simply terms of a mental equation? Either the genus *Homo* has no connection with the evolution of other animals, and possesses a mental capacity underived and specially created, or otherwise his reason, though far beyond, is not inseparable from the instinct of other animals. This is a problem that can perhaps be neglected by the ordinary zoologist, but it cannot be avoided by the psychologist. Either all other animals than man are simply automata, or human intelligence is a derivative. As Dr. Forel remarks: "Language and books are crammed with words which are taken for things," and "reason" and "instinct" are words used to denote a fundamental difference while they only express items of a close relationship. This is not a conclusion of the materialist, but will be a postulate of the theologian in the near future.

Dr. Forel's book, however, is not a disputation but a store of observations, his study of the senses of insects is profound, and he adds many new facts of his own discovery. He also advises caution in the method by which we attempt to gauge the sensory impressions of other animals: "We have the bad habit of calling odoriferous substances (*Reichstoffe*) the substances which are odoriferous for us. But the study of all animals very quickly shows us that the differences between the animal species are enormous, that a substance may be extremely odorous for one species and not so for another, and *vice versâ*. The dog, whose sense of smell is of extreme delicacy for certain tracts that we are incapable of perceiving, is insensible to the scents which

affect us in the highest degree, &c. It is very quickly observed in insects that the faculty of perceiving certain emanations is intimately allied to their course of life, to their wants, and to dangers which they have to avoid. The female of each species is odorous to her male. A plant that attracts a certain insect from very far off leaves others indifferent, and is absolutely inodorous to us," &c. This argument strikes at the root of many of the generalisations now so frequently met with in popular bionomics.

This volume is a real addition to our knowledge, and not in an entomological sense alone, though no entomologist should neglect its perusal. Prof. Forel is not infallible; he is somewhat emphatic with those whose conclusions are not in agreement with his own, but he has nevertheless given us the best book on the subject.

Animal Life. By F. W. Gamble, D.Sc., F.R.S., &c. Smith, Elder & Co.

This volume describes many phases of animal life, its subjects are of a selected nature, and it is written, as we are informed, from "the evolutionary standpoint"; from that standpoint the book must be read and appreciated. Evolution is a conception; it cannot be reduced to a formula, nor does it lend itself to the limits of a dogma. We can state facts that support it, and can find none that contradict it, but the most able evolutionist is the one who possesses the largest mental concept of the cosmic process, and not he who uses the most extensive terminology to express it. It belongs to no one science; it qualifies alike the thought and action of humanity as it accounts for man himself. The biologist, however, may be said to work under this conception; his facts are meaningless without it, his conclusions cannot escape it; the more he learns, observes, or discovers, a mighty hidden movement unfolds itself. Some devote their lives to the study of a single evolutionary manifestation, and in thus demonstrating a point not infrequently limit the conception of the whole. Dr. Gamble's book is a short sketch of a wide biological area; it is extremely suggestive, and gives an impulse to the evolutionary idea rather than adding to evolutionary

dogmas. The modern historian is now as much an evolutionist as the biologist, but his facts are more limited in time; he cannot precede man; the biologist goes back to a hoary antiquity.

Our space will not allow us to follow Dr. Gamble throughout. We will confine ourselves to his discussion on the colour of animals. His views on "sympathetic coloration in animals" is in the main what others have expressed by "assimilative" or "environmental" coloration. He gives some valid reasons against our regarding colour as produced solely for protective purposes. Observers have been led "to seek in protection the entire significance of cryptic colouring; to regard the avoidance of enemies or the near approach of prey as the reason for its existence; whilst to those who are not close observers the general vague resemblance between animals and their surroundings is illogically regarded as explicable for the same reason. But if we look back on the history of animal coloration . . . we realize that the pigments of animals are older than the effect they produce, and that the old nutritive, purifying, and respiratory uses of colour are the basis for the more recently evolved protective, warning, or mimetic values of coloration."

The volume is usefully illustrated, but the title 'Animal Life' has been already used by Jordan and Kellogg for a similar work published in 1901, and noticed in our volume for that year (p. 275).

EDITORIAL GLEANINGS.

In celebration of the fiftieth anniversary of the famous joint communication by Charles Darwin and Alfred Russel Wallace, "On the Tendency of Species to form Varieties, and on the Perpetuation of Varieties and Species by Natural Means of Selection," a special meeting of the Linnean Society of London was held on July 1st at the Institution of Civil Engineers in Great George Street. The President of the Society, Dr. Dukinfield H. Scott, occupied the chair, and there was present a large and distinguished company representative of learned and scientific societies, as well as the Danish and Swedish Ministers, and the following members of the Darwin family:—Sir George and Lady Darwin, Dr. Francis Darwin, Major Leonard Darwin, and Mr. William Darwin. There were also present Dr. Alfred Russel Wallace, whose name is inseparably associated with that of Darwin in the great event which provided the occasion for

the celebration, and the venerable Sir Joseph Hooker, one of the two friends to whom Darwin first confided his epoch-making conclusions.

The President, in welcoming the delegates and guests, said that they were met to celebrate what was without doubt the greatest event in the history of the Linnean Society since its foundation. Nor was it easy to conceive the possibility in the future of any second revolution of biological thought so momentous as that which was started fifty years ago by the reading of the joint papers of Mr. Darwin and Dr. Wallace, communicated to the Society by Sir Charles Lyell and Sir Joseph Hooker. In Darwin's contributions the now classic term "natural selection" was used for the first time. In Dr. Wallace's paper the same idea was expressed with equal clearness. With both authors the key to evolution was at the same time the key to adaptation, and the great characteristic by which living things were distinguished. Darwin and Wallace not only freed us from the dogma of special creation—a dogma which we now found it difficult to conceive of as once seriously held—but they afforded a natural explanation of the marvellous indications of design which had been the great strength of the old doctrine; and themselves, with their disciples, added tenfold to the evidence of adaptation. Any new development of the doctrine of evolution must be prepared to face fairly and squarely the facts of adaptation. He was proud to welcome, on behalf of the Linnean Society, the illustrious gathering which had assembled to commemorate an event so unpretentious in its circumstances, so profound in its significance. The presence of Dr. Wallace, one of the two creators of the theory, and of Sir Joseph Hooker, who brought it into the world, was in itself enough to render the meeting memorable. While regretting the absence of Prof. Weismann and Prof. Haeckel, those valiant champions of evolution, he rejoiced to welcome Prof. Strasburger, who represented in the present day the great school of Hofmeister, who helped to make straight the way for 'The Origin of Species.'

The ceremony of presenting the special Darwin-Wallace medals was then entered upon.

In making the presentation first to Dr. Alfred Russel Wallace, the President said that Dr. Wallace's brilliant work both in natural history and geography had often received distinguished recognition. In asking him to accept the first Darwin-Wallace medal, the Linnean Society was really offering him his own. There was nothing in the history of science more delightful or more noble than the story of the relations between Darwin and Wallace—the story of a generous rivalry in which each discoverer strove to exalt the claims of the other. It was a remarkable and momentous coincidence that both should have independently arrived at the idea of natural selection after the reading of Malthus's book, and it was a most happy inspiration that Dr. Wallace should have selected Darwin as the naturalist to whom his discovery should be communicated. Like Darwin, Dr. Wallace was, above all, a naturalist, a student, and lover of living animals and plants. It was to such men—those who had learnt the

ways of Nature in the open—that the doctrine of natural selection especially appealed, and therein lay its great and lasting strength.

Dr. Wallace, who was very cordially received on rising to respond, said that since the death of Darwin in 1882 he had found himself in the somewhat unusual position of receiving credit and praise from popular writers under a complete misapprehension of what his share in Darwin's work really amounted to. It had been stated not infrequently in the Press that Darwin and he discovered natural selection simultaneously, while a more daring few had declared that he was the first to make the discovery, and that he gave way to Darwin. To avoid further errors it would be well to give the actual facts. The one fact that connected him with Darwin was that the idea of "natural selection" or "survival of the fittest," together with its far-reaching consequences, occurred to them both independently. But what was often forgotten was that the idea occurred to Darwin in October, 1838, nearly twenty years earlier than to himself, and that during the whole of that twenty years Darwin had been laboriously collecting evidence and carrying out ingenious experiments and original observations. As far back as 1844, when he (Dr. Wallace) had hardly thought of any serious study of nature, Darwin had written an outline of his views which he communicated to his friends Lyell and Hooker. The former strongly urged him to publish his theory as soon as possible lest he should be forestalled, but Darwin always refused till he had got together the whole of the materials for his intended great work. Then at last Lyell's prediction was fulfilled, and without any apparent warning his (Dr. Wallace's) letter reached Darwin like a thunderbolt from a cloudless sky. How different from this long study and preparation, this philosophic caution, this determination not to make known his fruitful conception till he could back it up by overwhelming proofs, was his own conduct! The idea came to him, as it came to Darwin, in a sudden flash of insight. It was thought out in a few hours, and was written down with such a sketch of its various applications and developments as occurred to the mind at the moment. Then it was copied on to letter paper and sent on to Darwin, all in one week. He was the young man in a hurry; Darwin was the painstaking and patient student. Such being the facts, he should have had no cause of complaint if the respective shares of Darwin and himself had thenceforth been estimated as roughly proportional to the time that each had bestowed upon their theory when it was first given to the world—that was to say, as twenty years was to one week. If Darwin had listened to his friends and had published his theory after ten years, fifteen years, or even eighteen years' elaboration of it, he would at once have been recognized, and should ever be recognized, as the sole and undisputed discoverer and patient investigator of the great law of "natural selection" in all its far-reaching consequences. It was a singular piece of good luck that gave him any share whatever in the discovery. During the first half of the nineteenth century many great biological thinkers and workers had been pondering over the problem, and had even suggested ingenious but inadequate solutions. Why did so many of the greatest

intellects fail while Darwin and he hit upon the solution? A curious series of correspondences both in mind and in environment led Darwin and himself, alone among their contemporaries, to reach identically the same theory. First and most important, in early life both Darwin and he became ardent beetle-hunters. There was no other group of organisms that so impressed the collector by the almost infinite number of its specific forms, and their innumerable adaptations to diverse environments. Again, both Darwin and he had "the mere passion of collecting," an intense interest in the mere variety of living things. It was this superficial and almost childlike interest in the outward forms of living things which happened to be the only one that could have led them to a solution of the problem of species. It was the constant search for and detection of often unexpected differences between very similar creatures that gave such an intellectual charm and fascination to mere collecting, and when, as with Darwin and himself, the collectors were of a speculative turn of mind, they were constantly led to think on the why and the how of this overwhelming, and at first sight purposeless, wealth of specific forms among the very humblest forms of life. Then a little later both Darwin and he became travellers and observers in some of the richest and most interesting portions of the earth, and thus had forced upon their attention all the strange phenomena of local and geographical distribution. Thenceforward the mystery of how species came into existence began, in Darwin's phrase, "to haunt" them. Finally, both Darwin and he, at the critical moment when their minds were freshly stored with a considerable body of personal observation and reflection bearing on the problem to be solved, had their attention directed to the system of "positive checks," as expounded by Malthus in his 'Principles of Population.' The effect of this was analogous to that of friction on the specially prepared match, producing that flash of insight which led them immediately to the simple but universal law of the "survival of the fittest" as the long-sought effective cause of the continuous modification and adaptation of living things. He attached much importance to the large amount of solitude which he and Darwin enjoyed during their travels, and which gave them ample time for reflection. This view of the combination of certain mental faculties and external conditions that led Darwin and himself to an identical conception also served to explain why none of their precursors or contemporaries hit upon what was really so very simple a solution of the great problem. He accepted the crowning honour conferred upon him that day as a too liberal recognition of the moderate amount of time and work he had given to explain and elucidate the theory, to point out some novel applications of it, and extend those applications even in directions which somewhat diverged from those accepted by his honoured friend and teacher—Charles Darwin.

The President, in presenting the medal next to Sir Joseph Hooker, said it was with profound pleasure that they welcomed one whom Darwin fifty years ago wrote of as "our best British botanist, and perhaps the best in the world," words which had gained in force with

the half century that had elapsed since they were written. Sir Joseph Hooker's early appreciation and unswerving support of a doctrine too often misunderstood did more than any other circumstance to ensure a fair hearing among true men of science for the theory of the origin of species by means of natural selection, leading ultimately to its general acceptance.

Sir Joseph Hooker, who was loudly cheered on responding, said that, considering the intimate terms on which Mr. Darwin extended to him his friendship, he thought that on that occasion it would be appropriate if he could from his memory contribute to the knowledge of some important event in Darwin's career. He had selected as such an event one germane to this celebration, and also engraven on his memory—namely, the considerations which determined Mr. Darwin to assent to the course which Sir Charles Lyell and he suggested to him—that of presenting to the Society, in one communication, his own and Mr. Wallace's theories on the effect of variation and the struggle for existence on the evolution of species. They had all read Francis Darwin's fascinating work as editor of his father's 'Life and Letters,' where they found a letter addressed on June 18th, 1858, to Sir Charles Lyell by Mr. Darwin, who stated that he had that day received from Mr. Wallace, written from the Celebes Islands, a sketch of a theory of natural selection as depending on the struggle for existence so identical with one he himself entertained, and fully described in MS. in 1842, that he never saw a more striking coincidence. After writing to Sir Charles Lyell, Mr. Darwin informed him (the speaker) of Mr. Wallace's letter explicitly announcing his resolve to abandon all claim to priority for his own sketch. He (the speaker) could not but protest against such a course, no doubt reminding him that he had read it, and that Sir Charles knew its contents some years before the arrival of Mr. Wallace's letter, and that the withholding of their knowledge of its priority would be unjustifiable. He further suggested the simultaneous publication of the two, and offered, should Mr. Darwin agree to such a compromise, to write to Mr. Wallace, fully informing him of the motives of the course adopted. In answer Mr. Darwin thanked him warmly for his offer to explain all to Mr. Wallace, and in a later letter stated that he was disposed to look favourably on the suggested compromise, but that, before making up his mind, he desired a second opinion as to whether he could honourably claim priority, and that he proposed applying to Sir Charles Lyell for this. It might be interesting to recall that the last ordinary meeting of the session of the Linnean Society was held in the middle of June. The occasion of the meeting on July 1st was exceptional, being due to the death of the eminent botanist, Robert Brown. As a mark of respect to that great past President, the ordinary meeting of June 17th was adjourned, and a special meeting called in order to elect a successor to the vacancy on the Council caused by his decease, George Bentham being nominated in his place. The usual election of Council and officers had taken place at the anniversary meeting only a month before, and, oddly enough, among the new members of that body was Charles Darwin. Other papers

were read at the special meeting of July 1st, but the whole correspondence relating to the two papers on the evolution of species was subsequent to June 17th; indeed, the joint letter from Sir Charles Lyell and himself communicating them to the Society was only written on June 30th. Thus the death of Robert Brown was the direct cause of the theory of the origin of species being given to the world at least four months earlier than would otherwise have been the case. He concluded by asking their forgiveness for intruding upon their time and attention with the half-century old, real, or fancied memories of a nonagenarian as contributions to the history of the most notable event in the annals of biology that had followed the appearance, in 1735, of the 'Systema Naturæ' of Linnæus.

Lord Avebury wound up the proceedings with some recollections of Darwin, with whom his acquaintance began more than sixty years ago. In the parish of Down Mr. Darwin was much beloved. He was rather a puzzle, no doubt, to the villagers. One of his friends once asked the gardener how Mr. Darwin was. "Oh," he said, "my poor master has been very sadly"; and added confidentially: "I often wish he had something to do. I have seen him stand doing nothing before a flower for ten minutes at a time. If he only had some regular work I believe he would be much better." He received the highest honours from the Royal Society and the Institute of France, and in both cases 'The Origin of Species' was expressly excluded from the award. This was remarkable in two ways. It showed that even apart from 'The Origin' his other work was entitled to the highest scientific recognition; and if we are now astonished that 'The Origin' should have been excluded, we must remember the novelty of the views propounded. In fact, almost all—one might say all—authority was against him. At first, with few exceptions, not only the theological but even the scientific world was against him. A few years of study and reflection changed all this. It has changed also the religious dread with which his conclusions were received, and Mr. Balfour told us a few days ago that he looked to science as the great influence which was to raise and improve the condition of man.

[As the Official Report of the Linnean Society has not yet been published, we have relied on the reports given by the 'Times' and 'Daily Telegraph.' We have also to thank Mr. B. Daydon Jackson, the General Secretary of the Society, for considerable kind assistance.]